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An Introduction to FORTRAN Programming for the Advanced Scientific Computer

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The purpose of this report is to provide NRL research staff members with a brief, unified introduction to the Advanced Scientific Computer (ASC). It is written from the viewpoint of a research scientist (the user) who knows FORTRAN programming but who is not familiar with the complexities of the ASC and its Job Specification Language (JSL). It is intended to provide the simplest procedures necessary to get on the machine, run FORTRAN programs, and get answers.

All of the procedures in this report have been used successfully by the authors. The programming consultants of the Research Computation Center contributed most of the information in this report. They are available to provide more detailed information than is given in this summary.

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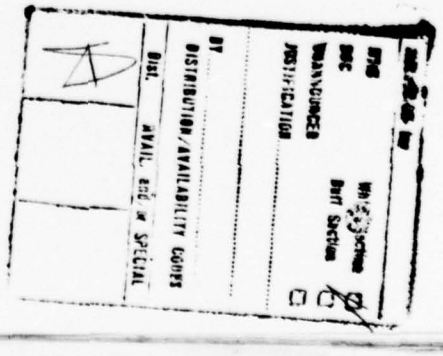


AN INTRODUCTION TO FØRTRAN PROGRAMMING FOR THE ADVANCED SCIENTIFIC COMPUTER

I. FOREWORD

The purpose of this report is to provide NRL Research Staff members with a brief, unified introduction to the Advanced Scientific Computer (ASC). It is written from the viewpoint of a research scientist (the user) who knows FØRTRAN programming but who is not familiar with the complexities of the ASC and its Job Specification Language (JSL). It is intended to provide the simplest procedures necessary to "get on the machine", run FØRTRAN programs, and get answers.

All of the procedures in this report have been used successfully by the authors. The programming consultants of the Research Computation Center contributed most of the information in this report. They are available to provide more detailed information than is given in this summary.

Obviously, this introduction is neither unique nor complete; *suggestions for improvements and additions* are welcomed by the authors.

A. References

For more detailed information, the user is referred to the following documents which are available from the Research Computation Center in Building A49.

1. Scientific Program Library User Manual for the Naval Research Laboratory; June, 1976.
2. ASC FØRTRAN Manual, Texas Instruments, Inc., #930055-2; Jan., 1976.
3. Job Specification Reference Manual, Texas Instruments, Inc., #930038-4; May, 1976.
4. ASC Keyboard Concentrator System User's Manual, Texas Instruments, Inc., #934732-2; May, 1976.
5. NRL Computer Notes 103 & 110.
6. CIFER, Card Image File Editor, Texas Instruments, Inc., #930032-1; Oct., 1974.

Note: Manuscript submitted May 10, 1977.

B. Notation Used in This Report

A simple program is short with few--if any--short subroutines. It is filed sequentially.

A complex program contains many long subroutines. It is partitioned into its various members and filed as a library (PD) file.

In the following programs, information written in lower case is to be supplied by the user.

Comments on the programming procedures are written in lower case and are indented from the actual program listing.

All listings begin in Column 1 and spaces--or lack of spaces--must be typed as given.

The account number, user code, and password are established with the Research Computation Center on their application forms. (See Computer Note #107).

The job name (usually the user's last name) designates the alphabetical bin in which output is placed at the Work Control Center.

For convenience, the authors' division (D79) and branch (B40) are used in these programs. The user must change these to the appropriate numbers.

The program name can contain 8 alphabetic characters.

Catalogue maintenance is described in Reference 3, Chap. 7. Also defined are file, node, pathname, version.

Macro is described in Reference 3, Chap. 9.

Alphabetic "O" (Oh) is written "Ø"
Numeric "O" (Zero) is written "O"
Alphabetic "I" (Eye) is written "I"
Numeric "1" (One) is written "1"

(CR) means Carriage Return: implied if not written at end of line

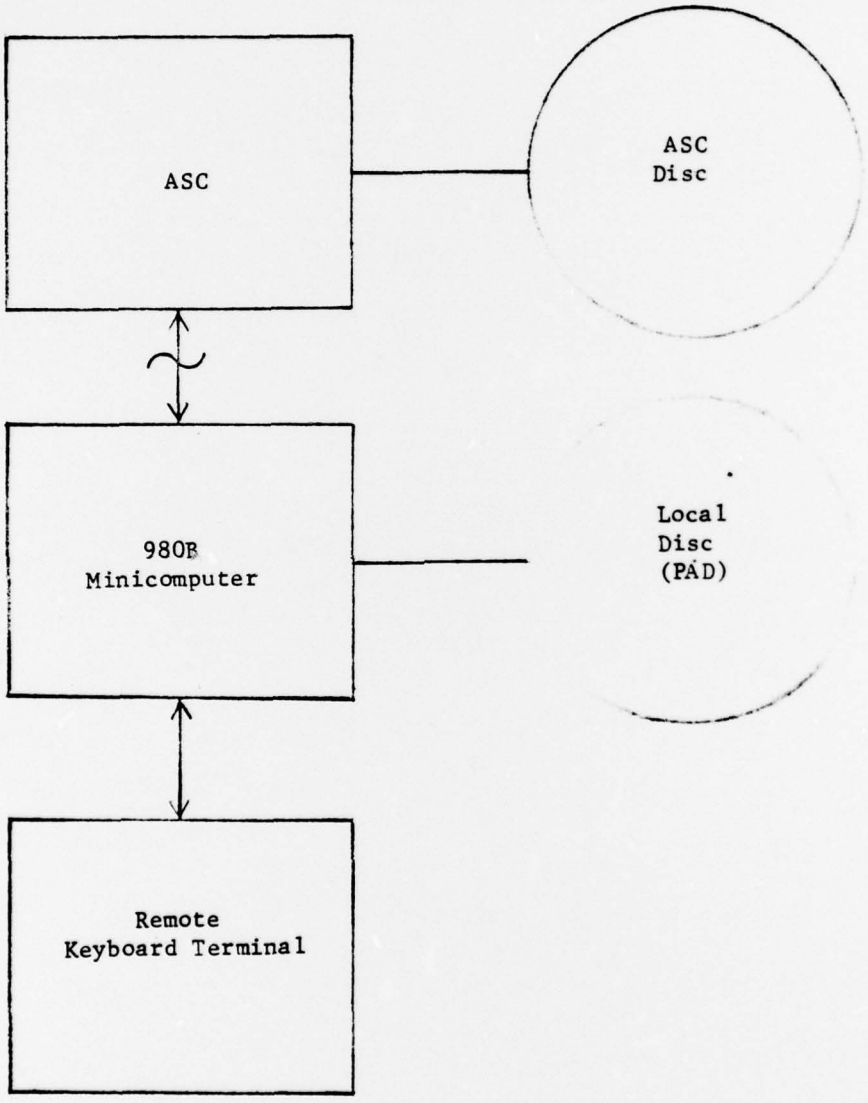
(S) means simultaneously pressing Control key and S key: this is sign-on

(C) means Control C: this terminates the previous command

(T) means Control T and tabs six spaces for the beginning of a FØRTRAN command: implied for FØRTRAN commands

(X) means Control X: this is sign-off and is implied if not written at end of session

C. Block Diagram of ASC Remote Keyboard Terminal System
(Reference 4)



II. ASC REMOTE KEYBOARD TERMINAL PROCEDURES

A. Simple Programs

1. Sign on and CReate a Program (see Reference 4)

If the ASC remote terminal uses an acoustic coupler, then first extension 75904 is dialed and when the tone is heard the telephone handset is put into the acoustic coupler.

(S)

computer responds
accountno.,usercode,password (CR)
computer responds
jobname (CR)
CR,programname

Type FØRTRAN program
To correct minor typing errors, press RUBOUT key

(C)

2. Execute a Program and Print Output at Remote Terminal

Wait for computer response after typing these commands. First the program is STored from the local keyboard computer memory to the ASC disc.

ST,programname

A special set of JSL macros is called upon so that the user can interact with the main ASC through the remote keyboard terminal.

/ MACASG S$,USERCAT/TERMINAL/MACRØS
L,A

Program CReated in paragraph 1 is listed for review.

/ FTNLX IN=programname

The ASC compiles and executes the FØRTRAN Program. A special file in the memory, FT06F001, is used for the PRINT output of all FØRTRAN programs. The file FT06F001 is LOaded from the ASC to the local keyboard computer memory. (See Appendix.)

LØ,FT06F001
ED,FT06F001
L,A

We List the file FT06F001 by EDiting it. FT06F001 contains the output of the program. Any programming errors and diagnostic messages will be printed now - if compiling and link editing are successful.

3. Example: Calculation of Chebyshev Polynomials

```
(S)
accountno.,usercode,password   (CR)
jobname
CR,CHEBYSHV
(T)    PRØGRAM CHEBYSHV
C  THIS PRØGRAM CALCULATES THE CHEBYSHEV
C  PØLYNØMIALS  TN(X)=CØS(N*ARC CØS X)
       X=0.50
       DØ 10 N=1,5
       T=CØS(N*ARCØS(X))
       PRINT 20,N,X,T
   20  FØRMAT(5X,'N=',I4,2X,'X=',F7.4,2X,'TN(X)=',F10.7)
   10  CØNTINUE
       STØP
       END

(C)
ST,CHEBYSHV
/ MACASG S$,USERCAT/TERMINAL/MACRØS
L,A
       Program is listed
/ FTNLX IN=CHEBYSHV
LØ,FT06F001
ED,FT06F001
L,A
       Output is listed
(X)
       Computer responds
(X)
```

4. Execute a Program and Print Output at Work Control Center

Follow procedure of paragraph 2. (See Appendix.)
After FTNLX type

```
/ FØSYS SYS.PRT
/ FØSYS FT06F001
```

Continue as before. Output will be printed at both ASC Work Control Center and at remote terminal.

5. Catalogue a Program from Remote Terminal to ASC. (See Computer Note 99.)

Follow procedure of paragraph 1, then type.

```
ST,programname
/ CAT USERCAT/D79/B40/usercode/programname,ACNM=programname
```

Follow procedure of paragraph 2, for example.

6. Editing and Executing Programs

This program gives the procedure for the repetitive editing (making correction, adding new commands, etc.) to a program already catalogued on the ASC.

```
(S)
accountno.,usercode,password
jobname
/ MACASG S$,USERCAT/TERMINAL/MACRØS
PD,MY,USERCAT/D79/B40/usercode/programname
AS,programname,MY
LØ,programname
ED,programname
```

Edit and correct program: The many keyboard commands are given in the appendices of Reference 4.

```
L,A
     program is listed
/ REL FT06F001,SYS.ØMØD,SYS.LMØD,SYS.PRT   (skip first time)
ST,programname
/ FTNLX IN=programname
RE,FT06F001   (skip first time)
LØ,FT06F001
ED,FT06F001
L,A
     Output is printed
     This procedure may be repeated until final program is
     obtained.
     Go back to ED,programname to repeat procedure.

/ RPLV MY,ACNM=programname
(X)
(X)
```

7. Enter Data from a Keyboard Terminal

After editing is completed, as in paragraph 6 type

```
ST,programmname
CR,FT05F001
     type input data; READ statement must be in FØRTRAN
     program
ST,FT05F001
/ FTNLX IN=programmname
     continue as before
```

8. Catalog Status of a User's Program

```
Ⓢ
accountno.,usercode,password
jobname
CS,USERCAT/D79/B40/usercode,LIST=VANS
     a user's files catalogued under this pathname are listed
```

9. Catalog Status of Other User's Program

```
Ⓢ
accountno.,usercode,password
jobname
LIMIT USCØ=otherusercode
CS,USERCAT/D79/B40/otherusercode,LIST=VANS
```

B. Complex Programs

1. Sign-on Procedure

Ⓢ
accountno.,usercode,password
jobname
Note: The security classification is assumed to be UNCLASSIFIED.
/ MACASG S$,USERCAT/TERMINAL/MACRØS
SE,terminalsectors,ASCsectors,CPtime

Note: This command SEts aside extra disc memory space for long, complex programs.
terminalsectors = no. of sectors for remote terminal
lower limit = 128 (default value)
upper limit = 32768
ASCsectors = no. of sectors reserved on ASC
lower limit = 3125 (default value)
upper limit = 12800
CPtime = Central Processor time in seconds (default value = 60 secs.)

User may have to wait for computer response (SET = OKAY); simple programs can be created now, however.

If the program is already catalogued on the ASC, use procedure of paragraph 3.

If the program is to be CReated and then CATalogued, use procedure of paragraph 2.

2. Create and Catalog Programs

Follow procedure of paragraph 1. Then type

```
CR,programname
```

Type FØRTRAN program
Note: It is good practice to CALL R$STØP, an ASC debugging aid (see Computer Note #94) before the first executable FØRTRAN command.

```
©
ST,programname
/ CAT USERCAT/D79/B40/usercode/programname,ACNM=programname
```

Now follow procedure of paragraph 4.
Note: It is good practice to print out a Job Activity (JA) after commands ST, / CAT, PD, AS, etc. to see if they worked. See Reference 4.

3. List Catalogued FØRTRAN Program

Follow procedure of paragraph 1. Then type

```
PD,MY,USERCAT/D79/B40/usercode/programname
AS,PDFILE$$,MY,USE=SHR
LØ,programname
ED,programname
```

Note: Here we are using some complex--but very useful--catalog maintenance procedures; see Reference 3, Chap. 7 or the RCC consultants.
Here we let programname = membername of file.
Also note that PDFILE$$ is the only name that can be used for Partitioned Direct Secondary (PDS) files.

```
L,A
```

program is listed

```
ST,programname
©
```

Now follow procedure of paragraph 4.

4. JSL Macro for Repetitive Executing and Cataloguing

This procedure is typed once only. See Reference 6. A set of JSL commands, which are used repeatedly, are combined into the macro we call JSL. After procedures of paragraphs B.1 and B.2 or B.1 and B.3 type

```
CR,JSL
/ REL FT06F001,SYS.ØMØD,SYS.LMØD,SYS.PRT
/ CIFER
<<COPY programname,PDFILE$$/programname
<<MERGE PDFILE$$,SEQN
/ FD FT06F001,BAND=4/12/4
/ FTNLX IN=SEQN,FTNØPT=(K),FTVERS=FX
```
Ⓒ

Note: Either the FX compiler (FTVERS=FX) or the NX compiler can be used here. The authors have found the FX compiler to be more convenient for problems requiring complex arithmetic. The optimizing compiler, NX, is useful for large production runs.

5. Repetitive Editing, Executing, and Cataloguing

The procedure of paragraph 4 need only be performed once. Then type

```
AP,JSL
RE,FT06F001   (Skip first time)
LØ,FT06F001
ED,FT06F001
L,A
     Output is listed.
LØ,programname
ED,programname
L,A
     Program is listed
     Modifications may be made.
     Go back to AP,JSL and repeat until final program is
     obtained.
```
Ⓧ
Ⓧ

III. ASC PUNCHED CARDS FOR COMPLEX PROGRAMS

1. Execute a FORTRAN Program on ASC

```
/ JØB jobname,accountno.,usercode,ØPT=(C,D,R)
/ LIMIT MIN=5,BAND=20
/ FTNLX ØPT=(K)
     FØRTRAN source deck
/ EØJ
```

2. Catalog Complex Program on ASC

```
/ JØB same as above
/ LIMIT same as above
/ PD MY,USERCAT/D79/B40/usercode

     Note:  MY is a dummy name for this particular program

/ CATN MY/programname,MXVR=2
/ CATN MY/programname/SØURCE,MXVR=2
/ CIFER
<<SPLIT *,SØURCE
     source deck
/ CATV MY/programname/SØURCE,ACNM=SØURCE
/ EØJ
```

3. Punch a Duplicate Deck of Cards

```
/ JØB same as above
/ LIMIT same as above
/ FØSYS SYS.IN,TYPE=PUNCH,CØPIES=n

     deck to be punched (less than 3200 cards)
     Note:  One copy is punched unless CØPIES = n is added
     after PUNCH; n = no. of copies

/ EØJ
```

4. List Deck of Cards

```
/ JØB same as above
/ LIMIT same as above
/ FØSYS SYS.IN

     deck to be listed (less than 3200 cards)

/ EØJ
```

5. Convert CDC FØRTRAN Deck to ASC Format

```
/ JØB same as above
/ LIMIT same as above
/ PD DICK,USERCAT/D42/B20/MCGIR1/LØAD
/ ASG SYS.LMØD,DICK,USE=SHR
/ FXQT ØPT=(Z,A),CPTIME=30000
    1    0    1    1
     deck to be converted
E
/ REL SYS.LMØD
/ FTN FTNØPT=(X,M),IN=FT07F001,FTVERS=FX
/ FØSYS FT07F001,TYPE=PUNCH
/ LNK
/ FXQT ØPT=(Z,A),CPTIME=30000
     data cards, if any
/ EØJ
```

6. List User's Catalogued Files

```
/ JØB same as before
/ LIMIT same as before
/ CATLST CPØPT=(A,B)
7USERCAT usercode 4
USERCAT D79      B40      usercode
/ EØJ
```

7. Enter Data in FØRTRAN Program

```
/ JØB same as before
/ LIMIT same as before
/ FTNLX ØPT=(K),DATA=INPUT
     FØRTRAN Source deck (READ Statement)
/ START ACNM=INPUT
     Data Cards
/ STØP
/ EØJ
```

IV. Appendix: Block Diagram of FTNLX Macro
Rectangular blocks are files.
Elliptical blocks are machine functions.